MAY 16, 1983

$3.00

FORTUNE

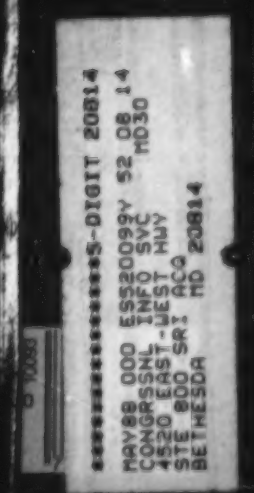
4/29/83
CB900-1

THE NEW UNEMPLOYMENT

HOW DETROIT IS REFORMING THE STEELMAKERS

THE NEXT BATTLE IN MEMORY CHIPS

A PRE-SUMMIT INTERVIEW WITH MARGARET THATCHER



May 16, 1983

Neil Selkirk's cover photograph suggests the plight of workers whose traditional skills may not fit them for the jobs of today or tomorrow. For a dissection of the problem, and what should and should not be done about it, see page 106.

FORTUNE

JOBS
Grasping the New Unemployment *by A. F. Ehrbar* 106

PICTURE PORTFOLIO
Jobs of the 1990s 116

STEEL
How Detroit Is Reforming the Steelmakers *by Steven Flax* 126

THE ADMINISTRATION
Chairman Feldstein Lands Running *by Peter W. Bernstein* 132

RELOCATION
Little Delaware's Powerful Lure for Big Banks *by Gurney Breckenfeld* 147

SEMICONDUCTORS
The Next Battle in Memory Chips *by Gene Bylinsky* 152

INTERVIEW
Margaret Thatcher: "There Aren't Any Brand-New Formulas" 158

TECHNOLOGY
Sighting Profits in Holography *by Gary Hector* 164

HIGH FLIERS
Diasonics' Winning Ways to Look Inside You *by Myron Magnet* 170

4
THE EDITOR'S DESK

6
IN THE NEWS
Wall Street's picks for Fed chairman, a Pepsi man joins Apple, the bankers reorganize Cuba's debt, Jaguar cleans up its act—and more.

13
LETTERS TO FORTUNE
On defense budgets, wine making, Value Line, and other matters.

19
THE WASHINGTON CONNECTION
Storm over the Roundtable's tax-hike proposal, and other matters.

97
FORTUNE FORECAST
An auspicious first quarter. The leaner look in inventories.

101
KEEPING UP
By Daniel Seligman

179
PERSONAL INVESTING
Foreign stocks beckon on two counts. By John J. Curran

185
ON YOUR OWN TIME
Attacking Everest and other peaks. By Marilyn Wellemeyer

197
BOOKS AND IDEAS
The agony of Africa's new nations. By Robert Lubar

FORTUNE (ISSN 0015-8259), May 16, 1983, Vol. 107, No. 10. Issued biweekly by Time Inc., 3435 Wilshire Blvd., Los Angeles, Cal. 90010. Second-class postage paid at Los Angeles, Cal., and at additional mailing offices. Subscriptions: U.S., U.S. possessions: one year $39; Canada: one year $49. Address all subscriptions and correspondence concerning them to FORTUNE, 541 North Fairbanks Court, Chicago, Ill. 60611. Principal offices: Time & Life Building, Rockefeller Center, New York, N.Y. 10020. Address correspondence concerning editorial material to FORTUNE, Time & Life Building, Rockefeller Center, New York, N.Y. 10020. J. Richard Munro, President, E. Thayer Bigelow, Treasurer, Charles B. Bear, Secretary. Authorized as second-class mail by the Post Office Department, Ottawa, Canada, and for payment of postage in cash. Member, Audit Bureau of Circulation. POSTMASTER: Send address changes to FORTUNE, Time & Life Building, 541 North Fairbanks Court, Chicago, Ill. 60611. © 1983 Time Inc. All rights reserved. Reproduction in whole or in part without permission is prohibited. FORTUNE is a registered mark of Time Incorporated.

SEMICONDUCTORS/GENE BYLINSKY

THE NEXT BATTLE IN MEMORY CHIPS

■ The surprising success of Japanese chipmakers in the market for advanced computer memories has done wonders to energize American producers. The next technological jump in memory chips is now imminent, and this time things look good for the Americans. "This," says an American chipmaking executive, "is going to be a different battle—one we may be able to win."

The competition centers on the so-called dynamic RAMs (random-access memories), which can store thousands of bits of data on a single chip. Dynamic RAMs, or d-RAMs, have emerged as the fastest-growing products in the world's fastest-growing industry. The current champ, the 64K (K meaning, roughly, a thousand storage cells), is the industry's largest-selling component ever—only three years after its debut. Sales are expected to top $900 million this year and peak at $1.6 billion in 1985. The Japanese have about 70% of the 64K market.

Now comes the 256K. Marketing in volume will begin at the end of this year. Because of its faster speed and greater storage capacity, it is expected to be an even bigger seller. Worldwide sales could reach $3.5 billion to $4 billion in four years—a chip with bigger sales than the whole U.S. machine tool industry achieved last year.

Demand for semiconductor memory seems immune to economic downturns. Analyst Michael J. Stark of Robertson Colman & Stephens in San Francisco points out that despite the worldwide recession, which held growth in the whole semiconductor market to a mere 2% in dollars in 1982, the memory market was up 23%. Assuming strong economic recovery, Stark adds, the memory market could leap by 40% next year, perhaps even 80%.

RESEARCH ASSOCIATE *Alicia Hills Moore*

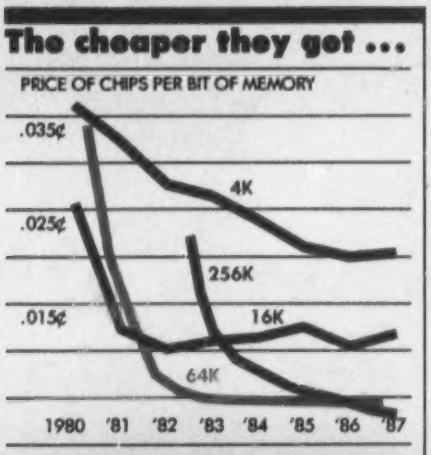
Of the two principal kinds of semiconductor memory, "volatile" and "nonvolatile," d-RAMs fall into the volatile category. Volatile memory loses its data unless constantly refreshed; the word "dynamic" indicates the need to constantly recharge the memory with tiny electric pulses to keep the stored data from vanishing. "Random access" refers to the ability to reach each memory cell at will—a d-RAM chip can be visualized as an incredibly miniaturized telephone network.

Ideally, every user would prefer nonvolatile memory, but it costs considerably more and in most versions does not permit immediate revision of data. Today it is used most extensively in electronic games and consumer products, where there is no need to alter the inscribed data. Even though dynamic RAMs suffer from amnesia if power fails, they are the most widely used of all memories. Besides being relatively cheap, they offer the advantage that data can be entered and immediately erased, to be replaced by new information. In general, makers of devices containing memory chips prefer those with the highest storage density, lowest power consumption, and fastest speed—selling, preferably, at a bargain. D-RAMs meet these wants better than other types. They are small in size and low in price (the 64K now sells for about $3.50 a chip), and their storage capacity is continually increasing.

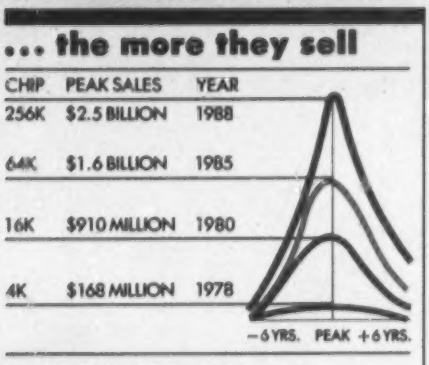
It was only 13 years ago that Intel Corp. brought out its 1K d-RAM chip, which became the industry standard. That chip had 1,024 cells. Since then storage density has increased in a fourfold jump every three years or so. The quadruplings are demanded partly by the need for standardization and partly by economics. The industry has made twofold increases standard, but the high cost of retooling to make a new chip rules out anything less than a fourfold jump.

In everyday usage, 256K is taken to mean 256,000 memory cells in each tiny chip, but that's not quite right. Actually, there are 262,144 cells—256 times the 1,024 of the original 1K. Each cell of a 256K consists of a storage transistor, or capacitator, which holds the tiny electrical charge, and a switch transistor that lets the charge in and out. In all, a 256K contains some 600,000 active devices in a sliver of silicon the size of a baby's fingernail. (To some Silicon Valley visionaries that's only a beginning: one is working to boost chip storage density to *millions* of bits. See page 155.)

This silicon rectangle, called a die, is packaged in a ceramic or plastic frame with 16 metal prongs as electrical connectors, be-



A section of a 256K memory chip



Tobogganing down *the learning curve is a way of life in the semiconductor memory business. In price per bit, the 256K should catch up with the 64K in 1985. (Estimates for upper chart from Gnostic Concepts Inc.) As prices fall, volumes keep climbing. (Lower-chart data from Motorola Inc.) The chip in the photograph is Western Electric's.*

coming a buglike chip. Remarkably, the size of these packages has remained much the same ever since the advent of the 1K d-RAM. The dies get only slightly larger as a new-generation RAM is introduced, and later, as manufacturers work their shrinking magic, the dies get smaller.

The chipmakers' success in jamming ever more memory cells into a chip has been paying off for users as well as greatly broadening memory applications. Together, 64K RAMs and single-chip microprocessors—which handle the logic, or arithmetic, function in computing—have helped create the personal computer industry. Personal computers, terminals, and other smallish electronic machines now absorb as much of the memory available on the merchant, or open, market as mainframes do. (Sales figures for the merchant market do not include the huge quantities of chips produced for their own use by IBM and Western Electric.)

The 256K will greatly enhance memory capabilities. A single 256K chip could store 10,000 telephone numbers or 5,200 words of text, compared with a 64K's 1,300 words. This greatly bolstered capacity will make many electronic machines four times smarter. And that will be achieved in many cases simply through removing the 64Ks now in use and plugging 256Ks into the sockets—a market already in place.

Grand-scale conversion to the 256K will start when the price drops to about five times that of the 64K (see chart). Today 256Ks are already being offered for volume delivery at about $40 per chip. A fivefold price differential will be sufficient because users will save on board space, auxiliary chips, and power.

Increased memory capacity is important by itself. It will do wonders for computer graphics, for instance, making possible a fourfold increase in the sharpness of pictures on the screens. But there is much more to the 256K. It promises faster access to the stored data—below 100 nanoseconds (billionths of a second), compared with the 150 to 250 nanoseconds required by most 64Ks. It also offers such unique features not yet available on the 64Ks as the "nibble" and "ripple" modes—ways of retrieving data in bigger dips than one bit at a time. With 256Ks, manufacturers will be able to build cheaper, more reliable, and more powerful computers, calculators, and numerous other electronic devices.

The d-RAM used to be an important contributor to the profits of U.S. semiconductor companies—until the Japanese came in. "The Japanese have clearly destroyed the profitability of the dynamic RAMs," says Intel Chairman Gordon E. Moore. The Semiconductor Industry Association recently estimated that five U.S. companies lost $143 million on 16Ks and 64Ks in 1981 and 1982. Advanced Micro Devices, with a 17% growth rate last year, has been the industry's best performer during the current recession, and even so, Jerry Sanders, the company's outspoken chairman, finds the Japanese competition in d-RAMs painful. "We do well in other components," he says, "but in d-RAMs we lose our shirt, shoes, and ass." The Semiconductor Industry Association has suggested in the past that the Japanese were losing money on d-RAMs to gain market share. The Japanese say it isn't so.

U.S. producers have stuck to the d-RAM business because they feel that more is at stake than profits. Many share Sanders's view that Japan is engaged in a "war of attrition" against the American semiconductor industry. Drawing a parallel, Sanders says: "First you give up Czechoslovakia, then Poland. What's next? France and England? You can't walk away successively from important parts of the business."

Now the 256K looms as a potential winner for U.S. companies. "Clearly," says Intel's Moore, "I don't expect to be losing money in d-RAMs forever." Getting the 256K out the door has become the highest priority at many U.S. companies. Some are in pilot production six months to a year ahead of industry observers' expectations.

THE COMING STRUGGLE for the 256K market is shaping up as the biggest test the Japanese have faced so far in their drive to gain primacy in the world semiconductor industry, and some Americans question whether the Japanese can repeat their 64K success in the 256K competition. It was one thing for the Japanese to achieve what Jack C. Carsten, a senior vice president at Intel, calls "a photographic rip-off of Mostek's 16K." The Japanese produced a workable 64K by quadrupling the layout of Mostek Corp.'s standard-setting device. Looking ahead to the 256K even then, Mostek and most other American memory producers decided that more complex technologies were needed to manufacture the 64K and got slowed down for a while.

It's quite another thing for the Japanese to master the innovative designs and processes needed to produce the 256K. What the Japanese are being forced to do this time around is what most American manufacturers chose to do with the 64K: push both product design and process innovation to the limit simultaneously. That risk-taking delayed most American chips by as much as two years and largely gave the 64K market over to the Jap-

A CHEAP-MEMORY CHASER PURSUES THE 4,000K CHIP

■ Chipmakers will start running out of room before long as they try to jam more and more transistors into a little rectangle of silicon. In Silicon Valley and elsewhere, a good many researchers are working on this overcrowding problem. Most of them are sticking with conventional design and aiming to reduce the already minuscule dimensions of the devices inscribed on the chips. One research team, though, is pursuing another course, involving a radically different chip design. If successful, this approach could revolutionize memory technology and related computer architecture.

The leader of this effort is Alton O. Christensen of Condesin Inc., a small, privately owned outfit in Fremont, California. At 61, he is one of Silicon Valley's oldest innovators. Christensen, whom almost everybody calls Chris, can look back on impressive achievements in semiconductor memory development. "I've been chasing cheap memories all my life," he says. While working for Shell Oil Co. in 1967, he devised the first manufacturable 1K dynamic RAM chip. Today semiconductor manufacturers pay Shell royalties on Christensen's patents; he estimates that Shell has collected more than $30 million. Royalties on another Christensen innovation, a very fast memory chip, go to Standard Microsystems Corp. of Hauppauge, New York, a company he founded.

MICHAEL ALEXANDER

Alton O. Christensen *guides a silicon wafer with thousands of "microguns" into an electron microscope for testing.*

Christensen is noted for being able to inspire co-workers. Big R&D teams, he feels, build a "box" around their problems. "My form of indoctrination," he says, "is to teach everybody to look for alternatives."

The alternative he is currently developing escapes the box of convention. His new chips contain no individual transistors or data-storage cells. Instead, one of the material layers in the chip serves as a depository of tiny charges put there from above by microscopic electron guns firing beams of electrons. As Christensen puts it, a beam drives a "nail" into the target. "Then the nail is removed except for its tip and the structure relaxes back to where it was before." The nail tips become data bits that can be detected by the electron beams.

Since no transistors or cells are needed to store the charges, the capacity of a Christensen memory chip is limited only by the smallest number of electrons that can be detected in a stored charge. Christensen's initial devices, now under development, will be designed to store 4,194,304 bits of data—16 times as many as the 256K (see story). So densely packed with data will these memories be that if an object the size of a beach ball were covered with them, it could hold all the information in the Library of Congress.

Christensen envisions future chips, based on the same concept, with the potential of storing 400 megabits—400 million bits. Even four megabits, however, is beyond what any other outfit is even talking about achieving. Several semiconductor companies are developing a conventional one-megabit d-RAM, but it won't come into use for another three or four years.

The design Christensen is working on has other advantages besides huge storage capacity. Unlike d-RAMs, the devices won't lose their data when the electricity goes off. They will provide fast access to data—500,000 times faster than disk memories, Christensen says. With all this, Christensen's new chips could eventually replace not only d-RAMs but also disk memories and could greatly improve the functioning of a variety of electronic devices.

Christensen did not invent the basic idea. The notion of storing charges by means of electron beams—emitted by a big vacuum tube serving as an electron gun—grew out of research at MIT's Lincoln Lab in the late 1960s. Some Lincoln scientists formed a company, Microbit, to develop a memory device based on the vaccum-tube technology, but that came to naught. General Electric also worked along similar lines without results.

Christensen carefully studied these failures and decided that the only way to make such a memory economical would be to use semiconductor technology. After two years he succeeded in microminiaturizing the electron guns. Now hundreds of microguns can be embedded in a silicon chip.

Condesin has successfully tested the microguns—tiny inverted pyramids etched in silicon—and demonstration of the complete device may come this year. The company expects volume production of the four-million-bit RAM to start toward the end of next year—just as the 256K is coming into its own.

Condesin (for Consulting, Design, Innovation) was organized in 1978 by Chris's wife, Lois Stone, a statistician who once ran reliability programs at NASA. She is the C.E.O., Chris vice president and technical director. The principal outside backer so far has been Technical Development Capital Ltd., a venture fund owned by British banks.

By Christensen's count, development of the new memory device still has to pass no fewer than 11 technical milestones. But Christensen is calmness and quiet confidence personified, possibly because he is not only an electrical engineer but also a former Lutheran minister. He writes fables for his grandchildren, often dealing with innovators. ("When the world was flat and became flooded, the man who invented the hole and the shovel became a hero.")

He is not ruffled by the question sometimes raised by semiconductor industry executives: Who is Alton O. Christensen? "They know my name in their patent departments," he chuckles. Neither is he concerned by occasional comments that his technology will never work. Even some semiconductor companies that aren't convinced it will work are beginning to take note. As a memory expert from one company said after looking over what Christensen is up to: "If this technology has a snowball's chance in hell, we've got to have it."

anese during that period. (See "Japan's Ominous Chip Victory," FORTUNE, December 14, 1981.) While most U.S. manufacturers struggled to develop and refine their technological innovations, the Japanese moved in smoothly with their less sophisticated but working 64Ks. Now, however, the competitive situation favors the American producers because their 64K technology is more directly applicable to the 256K.

Intel, for one, expects to be a winner in the coming competitive battle. Says Ronald J. Whittier, vice president and general manager of Intel's memory products division: "This time we have a chance of being among the top three producers, instead of being down in the mud." Intel has moved to a new chipmaking technology and believes it will produce chips that are smaller, faster, and more reliable, and use less power besides. "We have a minimum one year's lead," says Whittier. "I love a year's lead."

Texas Instruments, too, sounds confident these days. Says Walden C. Rhines, senior vice president of the semiconductor group: "Production ramp-up will occur much faster on the 256K than on the 64K. We're more experienced and better prepared. The parts we'll provide to users as samples will be production parts."

MOTOROLA, a seasoned high-volume producer of 64Ks, is also optimistic about the success of its 256K. So is Mostek, which in a prelude to its full-scale introduction of the 256K, plans to turn out 25 million to 30 million 64Ks this year. That would place it among the top producers, continuing the American comeback on the 64K front. (See "U.S. Chipmakers Are Back in the Race," FORTUNE, June 28, 1982.) At least four other U.S. companies are working on 256Ks: Fairchild, National Semiconductor, AMD, and Micron Technology of Boise, Idaho, a newcomer financed mainly by Idaho potato farmers bent on making money in non-edible chips—now there's a technology leap.

The most unpleasant development for the Japanese may be Western Electric's entry into the merchant market with an excellent 256K chip. AT&T's manufacturing affiliate has long made its own d-RAMs but has never sold them on the outside. Western Electric's size—$12.6 billion in sales last year—puts an American giant into the tussle. Industry observers, furthermore, place Western's 256K far ahead of Japanese devices in manufacturability, so much so that they expect Western to jolt the Japanese by turning out millions of 256Ks a month by the end of this year. The closest Japanese competitor, Fu-

The most unpleasant development for the Japanese may be Western Electric's entry into the market. The size of AT&T's manufacturing affiliate—$12.6 billion in sales last year—puts an American giant into the tussle.

jitsu, expects to be making only one-tenth that number by then.

U.S. manufacturers hold other advantages this time. For example, many of them have become well versed in the use of what is called "redundancy." Redundancy employs extra on-chip cells that allow the rerouting of electricity around defective cells after a chip is manufactured. This greatly increases the yield of usable chips from a given quantity of silicon wafers. Mastery of this technique in producing 64Ks gives U.S. manufacturers an edge over the Japanese because production of the 256K requires redundancy. The Japanese did not use redundancy in their 64Ks and now have to master this aspect of chip technology. American companies also have an advantage from their earlier use of "steppers," sophisticated lithographic devices that allow finer control in chipmaking. In the production of 64Ks, use of this advanced equipment looked a bit premature to the Japanese, and none of them adopted it.

As for quality, that is no longer the issue it once was. U.S. suppliers now rank on top with users as often as the Japanese do. Daniel L. Klesken, semiconductor industry analyst with Montgomery Securities in San Francisco, sees still another plus for U.S. producers of the 256K: "I find American users having second thoughts about going with the Japanese 100% in d-RAMs—especially when Japanese suppliers start coming after these users as competitors in the systems they build." Adds Robert B. Palmer, senior vice president in charge of semiconductor operations at Mostek: "This time the users won't have to wait for American chips."

In this round the Japanese have no choice but to go to greater complexity—that's the nature of the 256K. Quadrupling a 64K design won't do. The 256K demands new kinds of interconnections for faster signal speed to span its lengthened rows and columns of cells. That speed has to be attained by the use of new cell layouts and new process techniques. "In this generational transition," says TI memory designer G.R. Mohan Rao, "a brute-force approach will not work."

Some Japanese companies, notably Nippon Electric Co., are gambling on making their 256Ks with novel process technologies. To make a denser and smaller chip, NEC is going with a manufacturing process known as two-layer metallization, new to this type of memory. Intel's Carsten points to the complexities involved in the NEC approach. "Building semiconductors that way," he says, "is like building a house of cards. You start at the bottom with a perfectly polished wafer. Then you begin depositing layers of polysilicon and other substances on the wafer. You deposit, and then you etch. Deposit and etch." So the surface gets more and more irregular.

"Through a microscope the structure looks like the Grand Canyon, and the problem with putting on additional layers is that as the surface gets rougher and rougher, the ability to make good and reliable electrical contact gets tougher and tougher. Then you end up trying to deposit aluminum on top of that surface. It's sort of like spraying paint at a target four or five feet away. If the surface is a smooth plane, it's relatively easy to spray the metal. If it's very rough, if you don't get any paint on the edges, for instance, you won't be able to conduct any current, and the damn thing won't be reliable."

CARSTEN CONCEDES that if NEC can make the layering technology work, it may turn out to be "terrific," as he puts it. "If they can't, they have to go back to square one and start over again, as a number of us did on the 64K. I'd guess that it's going to be a near-term bust and a long-term boom when they finally get it sorted out. That's sort of what happened to us in the 64K."

Underestimating the Japanese is dangerous, of course. The Japanese record in semiconductor innovation is almost nonexistent and they still lag in design capabilities, but they have built formidable d-RAM production equipment. With extensive production facilities in place, and their home economy somewhat stagnant, the Japanese will get exceedingly aggressive in their export drive. For the time being, though, the Americans have an edge.

■ A powerful American comeback in advanced computer memories, capturing a dominant share of the potentially huge market for 256Ks, would do more than restore the pride of U.S. chip designers. All along, U.S. producers have been putting on a pretty good performance in memory technology. With success in the coming 256K battle, the chipmakers may start doing better at something they haven't done at all well at in recent years—making money. ■

MAY 30 1988

FORTUNE

THE NEW NEW-ISSUES MARKET

DOW VS. THE DIOXIN MONSTER

TECHNOLOGY: DEPRIVING THE RUSSIANS WITHOUT DIVIDING THE ALLIES

WHAT MAKES A CORPORATE LEADER

BEST AVAILABLE COPY

5-DIGIT 20814
MAY88 000 ES520099Y 52 08 14
CONGRSSNL INFO SVC
4520 EAST-WEST HWY
STE 800 SRI ACQ
BETHESDA MD 20814

The pencil-and-ink cover drawing by Jean-Claude Suarès depicts the tornado of initial stock offerings hitting the financial markets. For what's new and different about this new-issues boom, see page 50.

FORTUNE

NEW ISSUES
What's New About This Boom *by Irwin Ross* 50
Gulfstream: The Turkey That Learned to Soar *by Kenneth Labich* 58
Telerate: Big Bucks from Quick Quotes *by A. F. Ehrbar* 65

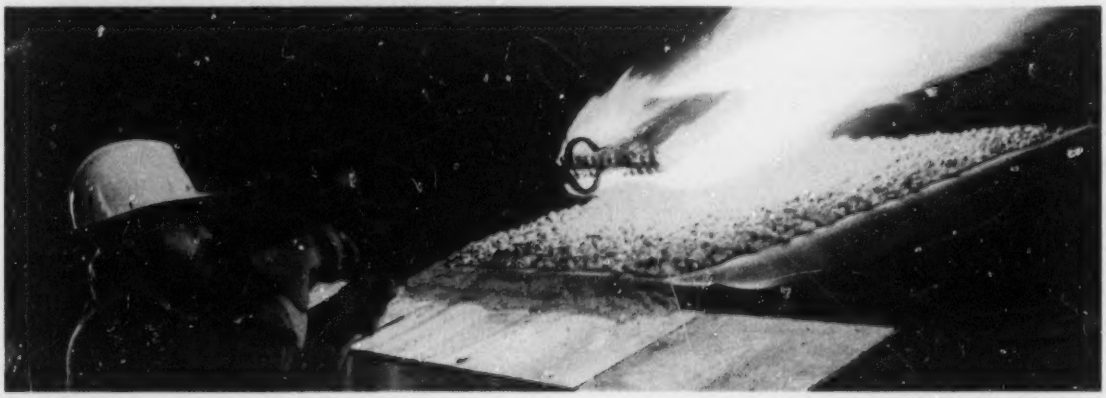
COMPANIES
Brawl in the Family at Superior Oil *by Susan Fraker* 70

BANKS
BankAmerica's Lifeline to Seafirst *by Gary Hector* 77

LAWYERS
Kodak's Revenge on Its Law Firm *by Brian Dumaine* 80

ENVIRONMENT
Dow vs. the Dioxin Monster *by Jeremy Main* 82

PICTURE PORTFOLIO
The Lively Art of Product Abuse 92



POLICY
Cutting Russia's Harvest of U.S. Technology *by Walter Guzzardi Jr.* 102

PRODUCTS
Fighting the Fakes from Taiwan *by Louis Kraar* 114

4
THE EDITOR'S DESK

6
IN THE NEWS
American Motors gets a toehold on the comeback trail, Caterpillar's labor settlement, Sotheby escapes a takeover—and more.

17
LETTERS TO FORTUNE
On patronage, the debt bomb, Harley-Davidson, and other matters.

33
THE WASHINGTON CONNECTION
Lobbying against acid rain—and more.

41
FORTUNE FORECAST
Signs of life in capital spending. A Japan-like surge in productivity.

47
KEEPING UP
By Daniel Seligman

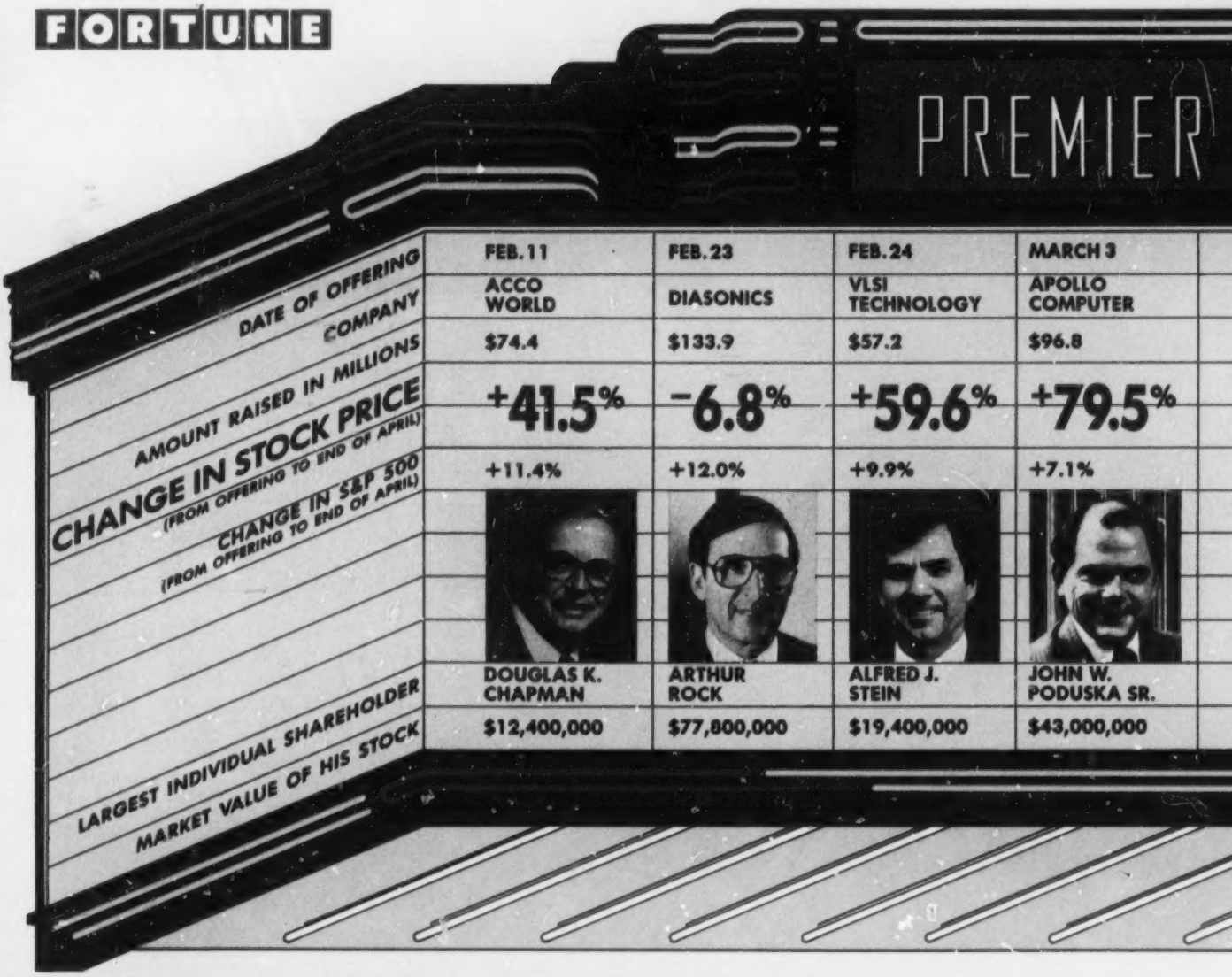
119
PERSONAL INVESTING
Getting high on drugstore stocks. By Peter Brimelow

125
ON THE ROAD
Planning the Washington visit. By Anna Cifelli

131
BOOKS AND IDEAS
Can colleges be managed? By Herbert I. London

135
OFFICE HOURS
What makes a corporate leader.
By Walter Kiechel III

FORTUNE (ISSN 0015-8259), May 30, 1983, Vol. 107, No. 11. Issued biweekly by Time Inc., 3435 Wilshire Blvd., Los Angeles, Cal. 90010. Second-class postage paid at Los Angeles, Cal., and at additional mailing offices. Subscriptions: U.S., U.S. possessions: one year $39, Canada: one year $49. Address all subscriptions and correspondence concerning them to FORTUNE, 541 North Fairbanks Court, Chicago, Ill. 60611. Principal offices: Time & Life Building, Rockefeller Center, New York, N.Y. 10020. Address correspondence concerning editorial material to FORTUNE, Time & Life Building, Rockefeller Center, New York, N.Y. 10020. J. Richard Munro, President, E. Thayer Bigelow, Treasurer, Charles B. Bear, Secretary. Authorized as second-class mail by the Post Office Department, Ottawa, Canada, and for payment of postage in cash. Member, Audit Bureau of Circulation. POSTMASTER: Send address changes to FORTUNE, Time & Life Building, 541 North Fairbanks Court, Chicago, Ill. 60611. © 1983 Time Inc. All rights reserved. Reproduction in whole or in part without permission is prohibited. FORTUNE is a registered mark of Time Incorporated.



NEW ISSUES/IRWIN ROSS

WHAT'S NEW ABOUT THIS BOOM

■ All bull markets give private companies the urge and incentive to go public, and this market is no different. What's different is the companies themselves—bigger and older than those behind the "hot issues" eruptions of the 1960s—as well as their owners, more financially astute. The buyers too are a different breed.

ILLUSTRATIONS BY ROGER GORMAN

PUBLIC OFFERINGS

MARCH 4	MARCH 15	MARCH 22	MARCH 23	MARCH 25	APRIL 8	APRIL 27
FORTUNE SYSTEMS	TELEVIDEO SYSTEMS	BIOGEN N.V.	VICTOR TECHNOLOGIES	MASSTOR SYSTEMS	GULFSTREAM AEROSPACE	TELERATE
$110.0	$123.8	$57.5	$78.8	$52.8	$167.2	$88.0
−14.8%	+54.2%	−20.7%	+20.0%	+34.4%	0%	−1.3%
+7.0%	+8.6%	+9.1%	+7.6%	+7.7%	+7.6%	+1.8%
GARY B. FRIEDMAN	K. PHILIP HWANG	WALTER GILBERT	CHARLES I. PEDDLE	ERIK O.J. SALBU	ALLEN E. PAULSON	NEIL S. HIRSCH
$26,200,000	$794,600,000	$8,400,000	$27,700,000	$10,900,000	$545,900,000	$66,700,000

The new stocks of 1983 *include these 11 nonfinancial corporations that made initial public offerings larger than $50 million. (Offerings of divisions of public companies were excluded.) Seven companies sell computer hardware or software. Of the others, Acco produces office supplies, Diasonics makes diagnostic equipment, Biogen is in genetic engineering, and Gulfstream makes corporate jets. The largest shareholder's stock is valued as of the end of April, but the figure shown also includes proceeds from any stock he sold in the offering.*

All of this is a mixed blessing for investors. New stocks underwritten by prominent firms seldom double in the first day or two of trading as new issues frequently did in the two binges of the early and late Sixties. Entrepreneurs and their backers are negotiating to keep more of the value for themselves. And investment bankers, who have learned to live with cut-rate commissions on practically every other kind of stock sale, are still making their accustomed rich fees from initial public offerings.

Nonetheless, the new merchandise is selling like mad. In the first quarter investors lavished $1.62 billion on the initial offerings of 107 corporations registered with the Securities and Exchange Commission—more than they spent for such issues in all of 1982. If that outpouring of money keeps up at the same rate for the whole year, the volume of initial offerings will surpass that of every other year since World War II, including the peak year of 1969, even when measured in constant dollars. The size of recent issues has also been stunning, with six (including two savings and loans) so far this year topping $100 million, compared with one in 1982, two in 1981, and perhaps no more than a half dozen others in all of American corporate history.

THE MARQUEE ABOVE highlights the largest nonfinancial public offerings of 1983 and suggests what going public has meant to the companies' chief stockholders as well as to investors who bought the stocks at the offering price. Two of the new companies—Gulfstream Aerospace and Telerate—are examined in articles on pages 58 and 65. The Gulfstream issue, probably second in size only to Ford Motor Co.'s $658-million offering in 1956, made Chairman Allen Paulson's stock worth $546 million overnight. And Telerate's securities quotation service so intrigued investors that the company was valued at almost $900 million despite its modest $41.6 million in annual revenues.

Those two stocks haven't done much for their new shareholders yet, and some buyers of other large issues (Fortune Systems, Biogen, and Diasonics) have lost money. But most of the big issues have so far proved good bets. Apollo Computer, a Chelmsford, Massachusetts, company that makes computer work stations for scientists and technicians, was issued at $22 a share on March 3. The first trade was at $25.50, and the stock closed the day at $26.50, providing the "flippers"—as the quick traders are called—with a 20% profit on the offering price. In early

May, Apollo was selling at $38.75—which represented a profit of 46% even for those who bought at the end of the first day. Televideo Systems of Sunnyvale, California, another computer stock on the marquee, went public on March 15 at $18 and rose 20% during the day to close at $21.625. Recently it has been selling at $27.25, a gain of 28% vs. 7% for Standard & Poor's 500.

There is nothing new, of course, in the observation that going public creates wealth—or at least makes palpable the latent and putative wealth in a private company. A lot of people made fortunes that way in the 1960s before the equity market as a whole went into a profound slump. But while the mechanics of instant enrichment are the same, many of the players in the present market are more sophisticated.

After inflation, probably the biggest booster of the size of the new offerings is the size of the new buyers. In past booms underwriters played largely to a retail market, as promoters of penny stocks and $5 stocks still do. Today the big action comes from institutions—pension funds, insurance companies, college endowment funds, bank trust departments, mutual funds. They are hungry for growth and less averse to risk than they once were. Their megabuck purchases have helped make initial offerings of $50 million to $80 million as commonplace as those of $10 million to $15 million a dozen years ago.

These days, moreover, the market for new stocks is international. In recent years Europeans have become increasingly important buyers. Hambrecht & Quist, the San Francisco investment banking firm, sells about a third of its issues to European customers. The strong (some would say overvalued) dollar hasn't discouraged them; compared with most investment opportunities in Europe, almost anything from Silicon Valley looks enticing.

Many institutions buy the stocks for long-term appreciation, but a large number are flippers. "The money managers are all in the performance game these days," says Robert L. Cooney, a managing director of the New York investment banking firm of First Boston. "A lot play the flipper game. If they can make $2 to $4, they buy it and—bang—it's quickly back in the market."

NONETHELESS, having institutions as major players has brought an element of sanity to the business. In the past, when the market was primarily dependent on retail customers, underwriters favored small issues that could shoot way up when hyped; supercharged performance was

RESEARCH ASSOCIATE *Elizabeth S. Silverman*

Hambrecht & Quist sells about a third of its issues to European customers. The strong dollar hasn't discouraged them; compared with most investments in Europe, almost anything from Silicon Valley looks enticing.

deemed necessary to keep the customers coming back. Another factor discouraging "shooters" is that nowadays the financial officers (and financial backers) of companies going public realize more clearly than they once did that a swift, steep run-up in the price of a stock is a sign of too much money left on the table.

Generally speaking, the latest crop of companies going public includes more solid operations, with longer operating histories than those of the Sixties. For a few years now, companies have been able to survive and grow without going public because they've been nurtured by venture capital groups—a source of support that was far less significant in the Sixties. In the last few years venture capital firms have sprouted across the U.S. They raised $4.9 billion during the five years from 1978 to 1982, more than ten times the money attracted in the prior eight years. With so much cash floating around, competition has been intense for entrepreneurs with promising "concepts" or technology to develop. Like the entrepreneurs, the venture capitalists get their big payoff when the company goes public, so naturally they get involved in discussions over price.

The underwriting firms that specialize in new companies are more professional too. In the 1960s the field was overrun with upstart firms such as the wildly prolific Charles Plohn & Co.—many of which, like Plohn, have since expired. In recent years the largest dollar volume of initial offerings has been handled by the so-called Four Horsemen—L.F. Rothschild Unterberg Towbin of New York, Alex. Brown & Sons of Baltimore, and two San Francisco firms, Robertson Colman & Stephens and Hambrecht & Quist. The Rothschild firm is the largest, with over 1,600 employees. The regional firms range in size from 75 employees (Robertson Colman) to 950 (Alex. Brown).

Some large investment banking firms—among them Shearson/American Express, Morgan Stanley, First Boston, E.F. Hutton, and Prudential-Bache—have been increasingly active. Morgan Stanley rarely underwrote new public companies until recently. It was the lead underwriter in bringing Apple Computer's $111-million public offering in 1980. (Apple came out at $22 and was recently selling at $49.) This year Morgan's major success has been Apollo.

The big securities firms, along with the Four Horsemen, float the larger and more solid companies with issues of $10 million and more. Below the top comes a second tier of underwriters, of which D.H. Blair & Co. and Rooney Pace, two Manhattan firms, are most prominent. They bring out far more speculative companies, often with no operating history at all. The prices in this arena are lower—generally under $10 a share—and the issues are smaller. Then there is the third tier—the penny stock promoters—where the ventures become pure blue-sky visionary. But in the present market euphoria, everybody seems to be doing well.

For investment bankers, the business is lucrative. The underwriters' take—the "spread," as the industry calls it—ranges between 6% and 7½% of the price paid by the buyers, which means $3 million or more on a $50-million deal. One-fifth of that goes to the managing underwriters, the firms whose names grace the front cover of the prospectus; sometimes it is only one firm, sometimes two or three. The rest of the spread is divided among the members of the syndicate—generally several score of firms—in proportion to what they actually underwrite and sell.

Competition for clients is vigorous. At times investment bankers establish an early relationship aimed at locking in a client by putting up venture capital (some have their own venture capital funds), and, when the moment seems propitious, bring the companies public. Most of the businesses are labeled "high tech"—which is more likely to mean innovative adaptations of new technology than technological breakthroughs—and many are in the medical field.

The extent of the entrepreneur's early dependence on venture capital and other financial backing largely determines whether he makes a killing when he goes public. K. Philip Hwang, the 47-year-old chief executive of Televideo, who was enriched the most this year, mainly financed his company out of earnings (see "The All-American Success Story of K. P. Hwang," FORTUNE, May 18, 1981). Hwang, a poor Korean immigrant who came to the U.S. in the 1960s, founded his company in 1976. He was remarkably unsuccessful at finding backers. Televideo began producing video-display terminals in 1979, prospering because Hwang knew how to manufacture cheaply. The company, which later moved into personal computers and mi-

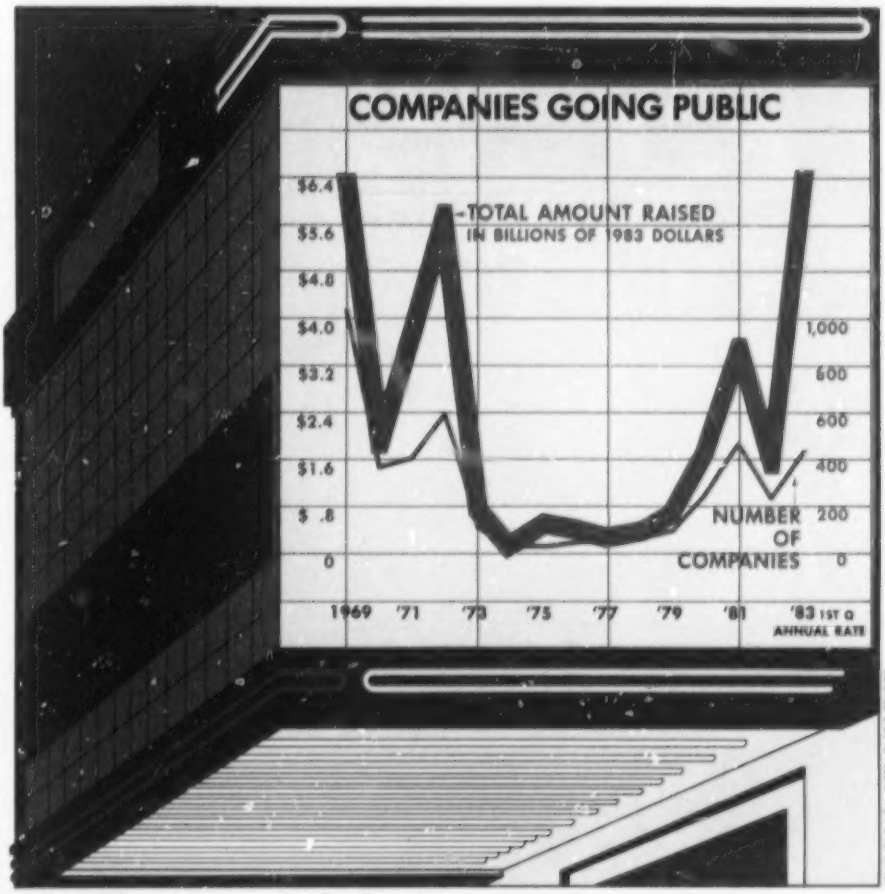
crocomputer systems, was profitable from the outset. Not until October 1981 did Hwang get an infusion of outside money—$5.25 million from a venture capital group. When Televideo went public two months ago, he owned 80.2% of it. Hwang sold 700,000 shares—which brought him $11,802,000—and he still holds stock (69% of the total), recently worth $769 million. Sometimes it pays not to have rich friends.

SIMILARLY, DAVID JACKSON, 45, the chief executive of Altos, a competitor of Televideo, made do without much help from outsiders during the formative years of his company, which has been profitable since it started in 1978. When Altos went public last fall, Jackson owned 63% and still held almost half after he sold around $6 million worth in the offering; the recent value of his remaining stake was $137 million. Jackson's total investment over the years was $98,000.

On the other hand, Allen H. Michels, who founded Convergent Technologies of Santa Clara in 1979, was compelled to give away large chunks of his company in return for $2.5 million from early backers. Michels contributed only $25,000 to his Silicon Valley operation, which makes computer work stations. Later he raised another $12 million privately. As a consequence, after the company went public last year, Michels owned only 4.4% of the shares. His stake, however, was worth over $11.5 million—and it has since more than tripled, along with the stock.

Winning the underwriting business from these entrepreneurs once they are headed for the public marketplace is often a matter of the chemistry between the client and investment banker. Michels, exuberantly irreverent, recently told how he selected Rothschild Unterberg Towbin. He had been talking to a number of underwriters when a friend of his alerted the Rothschild firm. Rothschild's representative rang up and a dinner meeting was scheduled at a Palo Alto restaurant.

Michels says that Vice Chairman Robert Towbin started with the wrong approach. "He began telling us all the reasons why both emotionally and professionally we would be comfortable with them. I voiced some objections—'This is rather quick, we just met you' and whatever. He slammed his hand down on the table and said, 'Look, what the f— do I have to do to get your business?' Now I can relate to that kind of dialogue. That one comment broke a lot of barriers because I felt I was dealing with a human being who badly wanted my business. I said, 'I think you have it, but I don't appreciate being run over by a tank and having Towbin stamped from my forehead to my toes.' "



Standing Room Only for New Issues

Until now the biggest upsurge in initial offerings came in 1969, when the value of all such issues cleared with the SEC came to $2.6 billion ($6.4 billion in 1983 dollars). The volume in the first quarter of this year, $1.62 billion, if annualized, would top the inflation-adjusted 1969 figure. Fewer companies are going public now, but the offerings are much larger than they used to be.

Michels subsequently signed up. He adds, "I prefer not to discuss the arguments that Towbin made as to why we should go with them, but you can imagine what they might have been by looking at my nose and my behavioral characteristics." All of which is Michels's way of saying that he is Jewish and preferred to be with a Jewish firm. For his West Coast co-manager, however, Michels chose non-Jewish Hambrecht & Quist, which had helped bankroll him.

Televideo's Hwang also went with Towbin, though hardly for ethnic reasons. Hwang had been miffed in 1981 when Hambrecht & Quist rejected an overture to become his underwriter. A year later, Hwang says, H&Q sent him a letter suggesting that the company might now be ready for the market. "I threw it in the trash basket," says Hwang. Like Michels, he was charmed that Towbin personally solicited his business, and with Hwang Towbin didn't bang on the table.

Timing an offering can be more important than picking an underwriter. When the market is in the doldrums, it is possible to peddle a good company, but the price is likely to be low and sometimes the "window" almost closes. Thus there was relatively little activity in the first half of 1982. Convergent Technologies made it to the market in May, but had it waited six months it doubtless would have fetched a better price. Altos Computer waited. Initially it was thinking of going public in August. In July, with the stock market in a terrible state and Altos's earnings looking rosy, the company put the offering off until November. The market, of course, turned up in August and didn't look back. "It was a bit of luck," says David Zacarias, the chief financial officer. Altos had planned to issue three million shares at a price between $17 and $19. Instead it increased the issue to 3.3 million and raised the price to $21.

Pricing is a delicate art, as is "sizing," deciding how many shares are to be sold. After the preliminary prospectus is filed with the SEC, usually a month or six weeks before

BEL HAYWARD

Donald Hebb *heads investment banking at Alex. Brown & Sons, big in medical issues.*

MICHELE SINGER

Sanford Robertson *of Robertson Colman & Stephens is a veteran midwife to new companies.*

the offering, the marketing people take over. They put on a "road show," taking company executives on a whirlwind tour of the financial centers of the U.S., and frequently of Europe, to tout the company before money managers and security analysts. The goal is to collect more tentative orders than can be filled. Buyers are reassured that an issue is desirable when they cannot get allotments as large as they would like. After the road show, and after the prospectus has emerged from the SEC, the pricing and sizing decisions are made. This happens after the market closes on the day before the formal offering.

MOST UNDERWRITERS say that the ideal price is one that will maximize the money raised and at the same time leave a little room for market appreciation—15% or 20% in the first day or two. On March 3, Morgan Stanley hit it just that way with Apollo. The computer company's competition is minimal and its management is highly regarded. So buoyant was the interest in Apollo that Morgan increased the size of the offering and raised the price to $22 from the $15-to-$18 range mentioned in the preliminary prospectus.

The same day that Apollo came to market, the folks at First Boston were meeting in New York with Gary B. Friedman, president of Fortune Systems, to price that issue. They were vastly encouraged by the market's reception of Apollo, and by the superficial similarity between the two companies. Like Apollo, Fortune makes computer work stations, but for the general rather than the scientific market. In the broader market, the competition includes Convergent Technologies, Altos, and Televideo, among others.

Nonetheless, First Boston was impressed by the volume of tentative orders for the stock; the firm increased Fortune Systems' issue from four million to five million shares, and raised its price to $22, which, as with Apollo, was a few dollars above the initial range. The issue bombed. Some would-be buyers changed their minds, and First Boston admits it had to "eat a little" of Fortune's stock, less than 5%. The first day out the stock traded below the opening price; recently it has been selling at $18.25. For First Boston it was a minor horror story; no underwriter wants customers to lose money on an issue.

Hambrecht & Quist made a grievous error in the other direction when it floated a $29,095,000 offering of a Chicago company called Information Resources Inc. at $23. The stock almost doubled before the day was out and was at $60 in early May. Red faces at H&Q, for the runaway price meant that the

client in effect had been shortchanged. "We still haven't figured out what happened with that one," says William Hambrecht.

There is a heady aspect to all these price decisions, for in the high-tech area the multiples are extravagant. Some market veterans say multiples are higher than those for comparable companies in the Sixties. When issued, Apollo was priced at 55 times per share earnings for the next 12 months, as estimated by Wall Street analysts; Fortune Systems had a multiple of 45; Diasonics, a maker of medical imaging equipment, 44; Intecom, a manufacturer of communication switching equipment, 77. By comparison, IBM has a multiple of about 13 times this year's estimated earnings. In many cases a purchaser of these companies for the long term would have had to assume a corporate annual growth rate of 30% or 35% a year to justify the prices. Only with such growth for, say, five years could some of these companies attain an earnings level that would bring their price-earnings ratios in line with those of mature high-tech companies today. How many investors make such a calculation is unknowable; when the market becomes euphoric the "greater fool" theory—the idea that a buyer can find someone even less sensible to sell to—often takes over.

If there is a downdraft in the market, it is nonetheless a safe bet that the high-flying multiples will come thudding down. Says Allen Michels: "We will see a fallout. I believe that the price at which we went public was insane. I don't know how to set value, but I know insanity when I see it."

However insane the multiples, the market's appetite for new issues and the eagerness of companies to go public show no sign of abating. At the end of April, 158 companies had preliminary prospectuses at the SEC, up from 126 at the end of January. So the stampede of new issues will continue, probably until the bull market dies.

■ More than the "greater fool" theory justifies investors' interest in companies that go public. The overall performance of these new issues has lately been good. Of the 52 nonfinancial issues larger than $5 million that came out in 1980—a list recently compiled by Shearson/American Express—35 increased in value through March 31 of this year while 16 declined, and the median performance was a gain of 48.4%. The 24 high-tech issues did even better, showing a median rise of 79.1%. The comparable median for the S&P 500: up 20%. But there's a kicker in all this—you have to be a big customer to get an allotment of some issues from your broker. And it takes nerve as well as cash to buy everything. ■

William Hambrecht *of Hambrecht & Quist has a knack for discovering high-tech companies.*

Thomas Unterberg and Robert Towbin *of L.F. Rothschild Unterberg Towbin lead in volume.*